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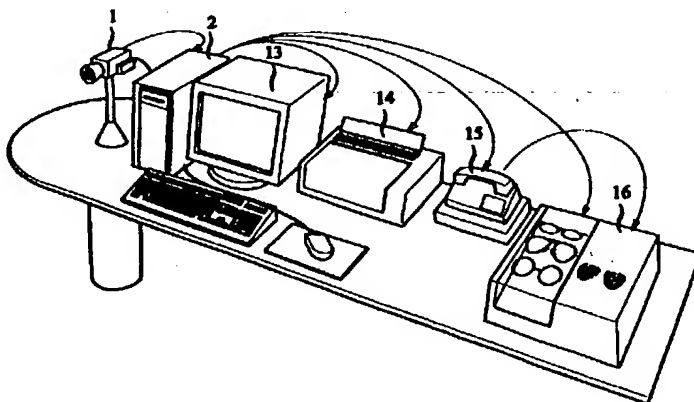
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(54) Title: SYSTEM AND METHOD FOR CHOOSING AND BUYING SPECTACLES AND COLOR CONTACT LENSES



**(57) Abstract**

A system and method for the automation of every step of the commercial activity of an optical shop (virtual optical shop) is provided, comprising an imaging apparatus, a computer unit (operating program, image memories, data memories, A/D and D/A converters), a display apparatus, a communication apparatus and an assembling machine. The image of the face of the customer is picked up by the imaging apparatus. According to the customer's cosmetic preferences and the features of the image of his face, the operating program presents a showcase with suggestions of best fit eyewear products (spectacles frames and lenses, and color contact lenses). From the suggested showcase, the customer is able to try on and compare eyewear products on the image of his face. Once an eyewear product is chosen, the purchase order may be confirmed, and the computer unit, connected to an assembling machine through a communication program and apparatus, provides immediate assembling and delivery of the chosen eyewear product(s). The virtual optical shop, may be reached through the Internet by the customer, allowing him to go through the whole process from his home personal computer.

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## SYSTEM AND METHOD FOR CHOOSING AND BUYING SPECTACLES AND COLOR CONTACT LENSES

5

### BACKGROUND OF THE INVENTION

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The present invention relates to a method and system for complete automation of the commercial activity of an optical shop. It includes a method for graphic simulation of the process of trying, comparing and choosing eyewear products, controlling the stock of eyewear products, buying the chosen eyewear products and assembling the eyewear products, allowing the concept of a virtual optical shop.

#### 1) EYEWEAR AND MODERN LIFE

20

Eyewear (spectacles and corrective lenses) has become a relevant aspect of modern life. A significant part of the population presents refractive errors (myopia, astigmatism and hyperopia), that is, optical disturbances that require corrective lenses for obtaining good visual acuity. Although hyperopia remains the most prevalent refractive error, myopia and astigmatism are the most important. Hyperopia causes less visual discomfort and may be partially or totally compensated by the crystalline lens accommodative effort, particularly in youngsters, whereas myopia and astigmatism may not at all be compensated by any ocular physiologic mechanism. Epidemiological surveys indicate that approximately 25% of the population is myope in Western countries and that such percentage increases in some Asian countries.

In addition to the significant prevalence of refractive errors, the importance of eyewear is also cosmetic and commercial. Eyewear plays an important role in individual presentation, which is vital in today's social and economical life.

5 The concept of eyewear is not limited to visual correction, but is also considered an important element of the individual presentation, with influence on his personality. This urges the development of systems allowing more efficient, quick and adequate methods for the process of choosing and buying spectacles frames  
10 and corrective lenses, including contact lenses, so that the consumer may be able to go through the whole process without the need to personally visit the optical shop(s), saving him time and money.

## 15 2) THE INCONVENIENCES FOR CHOOSING AND BUYING SPECTACLES TODAY

From the moment the diagnosis of a refractive error is made, until its definitive correction by spectacles, the consumer needs to go through a long, expensive and frustrating way.

20 Once suspecting the visual deficit, one has to undergo an ocular examination either with the optometrist or the ophthalmologist in order to confirm the refractive error and to obtain the prescription of the corrective lenses. Undergoing an ocular examination requires the interruption of activities or work,  
25 that may be more troublesome in case of delay of schedule at the professional's office or in case of pupil dilation, that takes many hours for recovery of normal vision.

After the ocular examination is over, the refractive error is detected and the corrected prescription is  
30 given, the visual problem still remains unsolved. The patient has to buy the corrective lenses, an additional step that includes visiting at least one optical shop.

Considering the way it is done today, visiting optical shops in order to choose and buy corrective lenses became a

time consuming, money consuming and bothersome activity.

As with any purchase, it is usually necessary to visit a few optical shops, in order to examine several brands and models of spectacles, and to compare them, including as to their price. In a shopping center, this task becomes easier, because one finds a few optical shops, separated by a short walking distance, in the same place. In addition, a shopping center offers parking facilities, other shopping and leisure options, and is safer. However, a shopping center also brings some disadvantages, such as the restriction to the brands handled by their shops as well as a tendency to more expensive prices.

The most important is that, no matter where the optical shop is located, some intrinsic problems do occur while choosing and buying spectacles, such as:

- the customer is limited to the brands and models dealt by a particular shop;

- the choosing process is normally oriented by the salesman, who separates and suggests models for trial; therefore, the choosing process is limited by the patience, expertise and preferences of the salesman, as well as by the brand and models available at the optical shop;

- choosing a specific spectacle frame is often not easy, requiring a detailed and slow analysis by the consumer, considering particularly its impact on the his cosmetic presentation. The environment at the optical shop definitively is not appropriate for such a delicate analysis, with great movement of people, and without the privacy necessary for choosing such an important personal belonging. Therefore, the environment at the optical shop for choosing an spectacle frame is not adequate;

- the customer who is buying eyewear usually presents a low uncorrected visual acuity. He is not able to accurately see the appearance of the spectacle frame on his face, because he has to remove his pair of spectacles to try on a new frame without corrective lenses. Therefore, the traditional optical

shop system does not allow for the consumer to see clearly his face with the selected frame on;

- a similar drawback occurs with the corrective lens. The traditional optical shop system allows no previous idea about the visual impact of the chosen corrective lens, as to its thickness, optical distortion, color and any surface coating treatment, since frames at optical shops come without any test corrective lenses;

- the customer needs to visit several optical shops in order to evaluate a sufficient number of models and to compare prices, what takes time, energy and money.

In conclusion, one might say that the system based on traditional optical shops, for choosing and buying spectacles and color contact lenses is inefficient, incomplete, tiring, tedious, bothersome and expensive.

### 3) DESCRIPTION OF THE RELATED PRIOR ART

Some prior inventions tried to solve the above mentioned problems, but reached only partial solutions, limited to technical aspects of the synthesis of the image of the face of the consumer with the image of the spectacles.

A simulation system for attachment of spectacles in which the state of the face as if wearing spectacles can be made was presented by Mori et al. in a system disclosed in U.S. Patent No. 4,730,260. In this method, through an image synthesis processing technique, an image of a person who has removed his own spectacles is picked up by a video camera. An image pickup signal of this person's image is A/D converted into a digital signal. This digital signal is stored into an image memory device. A display signal which is derived by synthesizing the data of the person's image stored in the image memory device and the data of a frame of spectacles to be selected is formed. The state in which this person wears the spectacles is displayed by the

display apparatus, thereby allowing a preferable pair of spectacles to be selected. In order to insert the face whose image is picked up into the range of the frame at the position of the frame of the spectacles on the screen of the display apparatus, the size of the face must be made coincident with the fixed position on the display screen. Therefore, in this system, it is necessary to perform correct and fine adjustments such as to move the photographing means such as the video camera, to match the correct size of the face of the consumer.

The invention presented by Ninomiya et al. under U.S. Patent No. 4,845,641 tried to eliminate the foregoing drawback, enabling a person's image to be picked up by a camera without needing the adjustment of the correct position of an object to be photographed, the adjustment of the inclination of the portion of both eyes to the horizontal line of the display screen, and the matching of the size of the fixed screen with the size of the person to be photographed. The embodiments described in this invention use as references either the distance between the pupils or the distance between the person and the imaging apparatus.

Tamura et al. proposed a system and method for spectacles frame image processing recording, disclosed in U.S. Patent No. 4,852,184 in which an image of a human face and the frame image can be synthesized by edge processing and color mixing processing. Basically, this invention improved the graphic quality of the image of the frame border, and allowed variable presentation options.

The above cited patents were restricted to the technical aspect of the synthesis of the image of the face of the consumer and the image of the spectacles frame. As a matter of fact, those synthesis effects may be nowadays performed by ordinary currently available graphic softwares. The above cited patents did not care about several other important points related to the complex activity of optical shops. They did not include other eyewear products, such as color contact lenses. They did not cover



important aspects related to the eyewear choosing and buying process, either cosmetic (fitting the product to the kind of face of the customer) or commercial (improved efficacy and speed for the process of choosing, buying, paying, assembling and shipping). They  
5 did not offer a showcase which the customer might choose eyewear products from.

The present invention was developed to solve those drawbacks, enabling the automation of every consecutive step optical shop activity, allowing the conception of a **virtual optical**  
10 **shop**, which is very important in contemporary life, providing speed, comfort, better and more complete choice, therefore the whole process of choosing and buying eyewear without the need to personally visit the optical shop.

## SUMMARY OF THE INVENTION

In order to eliminate the above pointed drawbacks, related to the traditional process of choosing and buying spectacles (frames and lenses) and color contact lenses, the present invention is provided. It is an object of the present invention to provide a method and a system to encompass every step of the whole process of the optical shop activity, including the commercial and cosmetic features.

According to the present invention, there is provided a method for automation of the whole process of choosing and buying eyewear in an optical shop, comprising the steps of:

- picking up the image of the face of a customer using an imaging apparatus, such as a video camera;

- selecting and suggesting a group of spectacle frames, according to the preferences of the customer and according to cosmetic features of the face of the customer, using specific computer operating programs;

- automating the comparison and choosing of spectacle frames and lenses, as well as color contact lenses by the customer, through the synthesis of the image of any chosen eyewear product with the image of the face of the customer, using basic computer graphic programs;

- automating the process of buying eyewear products by the customer, allowing the whole process to be carried out without the need to go personally to the optical shop;

- automating the process of assembling and delivering eyewear products, using a connection (direct or modem) between the computer unit and the assembling machine, allowing either immediate delivery or automatic shipping to the customer.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a diagram of an arrangement of the components of the  
5 system for choosing and buying spectacles and color contact lenses  
(virtual optical shop) according to the present invention.

FIG. 2 is a graphic diagram of an arrangement of the components of  
the system for choosing and buying spectacles and color contact  
10 lenses (virtual optical shop), according to the present invention,  
as it would look in a regular place.

FIG. 3 is a diagram showing a flowchart for the operation of the  
system for choosing and buying spectacles and color contact lenses  
15 (virtual optical shop), according to the present invention.

FIG. 4 shows, on the display apparatus, a spectacle frame image  
synthesized with the image of the face of a customer, the showcase  
17 with some suggested frames and the menu bar 18.

20

FIG. 5 shows, on the display apparatus, a comparative mode, in  
which it is possible to compare up to four different selected  
frames, synthesized on the image of the face of the customer, the  
showcase 17 with some suggested frames and the menu bar 18 .

25

## DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the present invention will be described below with reference to the accompanying drawings.

5           FIG. 1 is a block diagram of an arrangement of a system for choosing and buying spectacles and color contact lenses (virtual optical shop) according to the present invention, that comprises: a imaging apparatus 1, a computer unit 2; a display apparatus 13; a printer 14; a communication apparatus 15 and an  
10 assembling machine 16.

The imaging apparatus 1, usually a video camera, picks up an image of the face of a person, with which the image of the spectacles or the color contact lens is synthesized. The imaging apparatus is not limited to a video camera but may also  
15 be another device, such as a image scanner (hand, table or film scanner).

The computer unit 2 comprises: an A/D converter 3; a D/A converter 4; a CPU (Central processing unit) 5; an image memory 6 for trial products (spectacles frames and lenses, and color contact lenses) to be synthesized with the image of the  
20 face; an image memory 7 for showcase products (spectacles frames and lenses, and color contact lenses) to be chosen by the customer; an operating program 8; a communication program 9 to link the computer unit to the assembling machine and/or to the laboratory; a  
25 data memory 10 for information concerning the customer; a data memory 11 for information concerning the products (spectacles frames and lenses, and color contact lenses); a data memory 12 for information concerning the control of stock of the products dealt by the virtual optical shop. The composition and mechanism of  
30 functioning of a computer system are well known and don't need detailed explanation. Both the D/A conversion and A/D conversion of the image pickup signal are equally well known. The mechanism of functioning of the communication program, through the modem is also

well known.

The image memory 6 (trial products) comprises frame data memory of different brands, models, sizes and colors, corrective lenses data memory (spectacles or contact lenses) of  
5 different brands, and colors, adequately prepared to be synthesized with the image of the face of the customer.

The image memory 7 (showcase), consists of a data-base of images, comprising frames of different brands, models, sizes and colors, as well as corrective lenses (spectacles or  
10 contact lenses) of different brands and colors, presented in a similar way as a showcase or a catalogue, which is examined by the customer prior to choosing which products to try on.

The operating program 8 controls and coordinates the elements of the system of the present invention and  
15 executes every step of the method of the present invention.

The data memories 10, 11 and 12 comprise various data-bases related to customer descriptive information, purchase orders and eyewear products in stock, such as spectacles frames and lenses, and color contact lenses.

20 A display apparatus 13, usually a computer screen, on which the face of the customer is shown, synthesized with different options of spectacles frames and lenses, and color contact lenses. Its principle and mechanism of functioning is well known and does not need detailed explanation.

25 A printer 14, used to print out data describing details of the purchase, the purchase order and the image of the face of the customer synthesized with selected eyewear product(s) to be ordered and/or purchased.

30 A communication apparatus 15, usually a modem, to link the computer unit of the system of the virtual optical shop to the distant customer, at the beginning of the process, in case of transferring the image of his face through the Internet, or to link the computer unit of the virtual optical shop either to the laboratory or to the assembling machine, at

the end of the process, in order to transfer the purchase order to the laboratory or to expedite the immediate assembling and delivery of the final product, respectively.

5 An assembling machine 16, consisting of a machine in which the lens block is ground or cut in accordance with a frame shape, and in which the finished lens is fitted in a frame previously selected by the consumer.

Referring now to FIG. 2, there is shown a graphic representation of the arrangement of the components of the system for choosing and buying spectacles and color contact lenses (virtual optical shop), as it would look in a normal commercial place. This unit might be located at varied places, such as a shopping center, the office of an optometrist who dispenses eyewear products, and the office of an ophthalmologist who dispenses eyewear products. An important inventive aspect of the present invention is that the method and system herein described may be comprised in an autonomous satellite unit, outside and independent of the optical shop. At this virtual optical shop unit, the customer would be able go through the whole process of choosing and buying eyewear products (spectacles and color contact lens), without the need to visit personally one or many optical shops. The image and data memories comprised in the present invention would have capacity to gather information and varieties of eyewear products from an unlimited number of optical shops and brands, so that the customer, using the virtual optical shop as described in the present invention, would be able to simulate a visit to a great number of optical shops. In addition, the system presented in this invention may also be reached through the Internet, so that the customer may go through the whole process of choosing and buying eyewear from his personal computer at home. In this case, the customer transfers the image of his face through the Internet, using a communication program and apparatus, the payment is done by credit card and the purchase is sent through the mail.

Referring now to FIG. 3, the process flow for

choosing, buying and shipping the spectacles or color contact lenses in the system (virtual optical shop) presented in this invention and configured as above will be described in detail. As shown in FIG. 3, the initial input process is carried out on the part of the virtual optical shop unit and the numbers following "S" denote step numbers.

[S1] The process of choosing, buying and shipping eyewear products (spectacles frames and lenses, and color contact lenses) is started at the computer unit 2. The operator clicks on the image pick up option of the main menu, the customer sits on an appropriate chair for image pick up, properly located for correct dimensional correspondence between the image of the face of the person and the image of the spectacles frames and the color contact lenses from the image memory. The image of the face of the person is seen on the computer screen in real time and the position of the chair is adjusted. Then, the image of the face of the person is pick up and transferred to the computer. The above described method for picking up the image of the face of the customer by the video camera is the usual way of acquiring the image. A second possible method is picking up the image of the face of the customer through the Internet, using a communication program and a communication apparatus. This second possibility allows the customer to go through the whole process of choosing, buying and shipping the spectacles or color contact lenses without the need to go personally to the virtual optical shop unit.

[S2] In this step, customer general information such as name, age, sex, address, phone number, fax number, and day of birth is entered. This information is kept at the data memory, and is used to identify the ongoing session as well as for future contact (mailing list, phone or Internet) with the customers.

[S3] The customer specifies the eyewear product he wants to try on, either spectacles (frames and lenses) or color contact lenses.

[S4] In case of opting for spectacles, the customer is asked about various preferences concerning the spectacles frame and the

spectacles lenses, such as, frame shape, frame material, frame style, suggested price level, type of nasal support, lens material, lens color, and special lens surface treatment. Considering the above mentioned aspects of the spectacles frame and lens, the program selects and suggests, from what is available at its image memory, frames and lenses that best fit both the above cosmetic preferences and the format and dimensions of the face of the customer. The format and dimensions of the face of the customer is analyzed by the operating program on the image of the face of the customer, picked up at the beginning of the method (step 1). This selection is presented in form of a showcase 17, comprising suggestions of frames in a similar way as a catalogue, as shown in FIG. 4 and FIG. 5. In the case of the color contact lenses, no selection is needed and the showcase includes all available options of colors and brands.

[S5] The operating program takes some anatomical references on the face of the customer (such as the position the pupils, the interpupillary distance), that are used to guide the positioning of the selected frame and/or color contact lenses on the face of the person. The operator browses through the suggested frames and/or contact lenses, and the customer chooses which ones to try on. Each chosen spectacles frame or color contact lens may be synthesized on the face of the customer, as shown in FIG. 4 and then either confirmed or discarded, using the available options on the menu bar 18. The image of the spectacles frame, when synthesized on the image of the face of the customer, presents an effect of transparency in the optical zone, corresponding to the lens zone, whereas in the region of the frame it covers the face of the customer. When synthesizing the images of the spectacles color lenses and the color contact lenses, the program uses a transparency effect. Both for the frames and lenses, the synthesis and display of the images are done by the use of well known image processing techniques, available in standard current graphic softwares. The customer may test every selected and suggested



eyewear product. He also has also the option to browse all remaining eyewear products of the image memory. However, this will be a very tiring option. For each and every product on the display apparatus 13, descriptive data will be shown, including the model, color, material and price. For each item in the showcase 17, the program also shows the options of color, as shown in FIG. 5. Each time the customer chooses a product from the showcase, it is automatically synthesized with the image of the face of the customer, as shown in FIG. 4. The image of the frame synthesized with the image of the face may be kept for posterior comparison or immediately discarded. Up to four kept images may be simultaneously compared, as shown in FIG. 5. In case of not liking any of the suggested frames of the showcase, the customer has the option to restart the whole process, changing his preference options. Once a few spectacles frames have been selected, the customer may then examine them, either each one separately, in the one view screen (FIG. 4), or in the comparative screen, showing up to four different eyewear products simultaneously (FIG. 5). The customer will then finally choose his preferred product, discarding all the remaining selected ones. A similar routine is done for the trial and choosing of color contact lenses. On any selected spectacles frame, the customer may try different lenses, varying color and surface treatment, and then confirming his final choice of spectacles frame and lens.

[S6] The operating program shows the final chosen eyewear product on the face of the customer, either a spectacle frame and lens, or a color contact lens, and there is also the option to show other characteristics, such as material, model, size, color, and price.

[S7] The customer is then asked to confirm the purchase order. If he does, a purchase order menu comes out on the screen, showing the complete identification of the customer, as entered at the beginning of the process (Step 2), the complete description of the confirmed product, as well as the image of the face of the customer synthesized with the chosen eyewear product. At this step, the

operator enters the prescription of the lenses (spectacles or contact lenses), the price, the way of payment, and the delivery schedule.

[S8] The computer unit may be connected to an assembling machine, which, once receiving the description of the chosen and purchased product, is able to grind and cut the appropriate lens block, fitting it to the chosen spectacles frame. Such kind of assembling machines are well known in the eyewear market and do not need further explanation as to their principles. In this case, there will be an immediate delivery of the chosen eyewear product (spectacles frame and lens). The color contact lens does not need to be assembled and, if present in stock, it may be immediately delivered.

[S9] The computer unit of the virtual optical shop may be connected, through the communication program and apparatus, to a central laboratory, where the purchase order is transferred to.

[S10] At the laboratory, the assembling process is carried out at the assembling machine according to the information of the purchase order transferred from the computer unit.

[S11] The eyewear product, once assembled, is shipped to the customer.

[S12] In case the customer does not confirm the purchase, the whole process may be saved and kept for future retrieval. The customer may also have a print out, containing the image of his face synthesized with the chosen product, and all the descriptive data of his session. The customer will then be able to show his simulation to other people and later decide about his confirmation. In case of late decision, the whole process may be again retrieved from the computer memory.

The system and method of the invention herein presented show great commercial potential. They are useful for allowing a significant improvement of the efficacy of current available methods of commercial activity of optical shops. They allow complete automation of the whole process of choosing,

comparing and buying eyewear products, such as spectacles frames and lenses, and color contact lenses. They allow the automation of all the activities of an optical shop, including the control of stock, making the whole process faster and more efficient. More  
5 important, they effectively make possible the concept of a virtual optical shop, which may be accessed by the Internet, and in which the whole process for eyewear products choosing and buying may be carried out without the need for personally going to an optical shop. Through the Internet, the customer will be able, using the  
10 present system and method, to choose and buy eyewear products from his home personal computer. With the herein presented system and method, the stock of eyewear products of an unlimited number of brands and optical shops might be put together in the image and data memories, significantly improving the options for the  
15 customer, who would no more be limited to the stock of a particular optical shop.

What is claimed is:

1 - A system and method for choosing and buying eyewear products (spectacles frames and lenses, and color  
5 contact lenses) comprising an imaging apparatus; a computer unit having a CPU, an A/D converter, a D/A converter, a communication program, image memories (trial and showcase products), data memories (customer, products and stock info), and an operating  
10 program; a display apparatus; a communication apparatus; an assembling machine; and a printer, and in which the whole activity of an optical shop may be simulated and/or automated.

2 - A system and method for choosing and buying eyewear products (spectacles and lenses, and color contact  
15 lenses) according to claim 1, further comprising the capacity to work as virtual optical shop, i.e. a satellite autonomous unit, which may be accessed by the Internet, and in which the whole process for eyewear products choosing and buying may be carried out without the need for the customer to personally go to an optical  
20 shop.

3 - A system and method for choosing and buying eyewear products (spectacles and lenses, and color contact lenses) according to claim 1, further comprising the capacity to  
25 work as a data-base of an unlimited number of optical shops, so that the customer may be able to try on, choose, buy and order eyewear products without the need to personally visit many different optical shops.

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FIG. 1

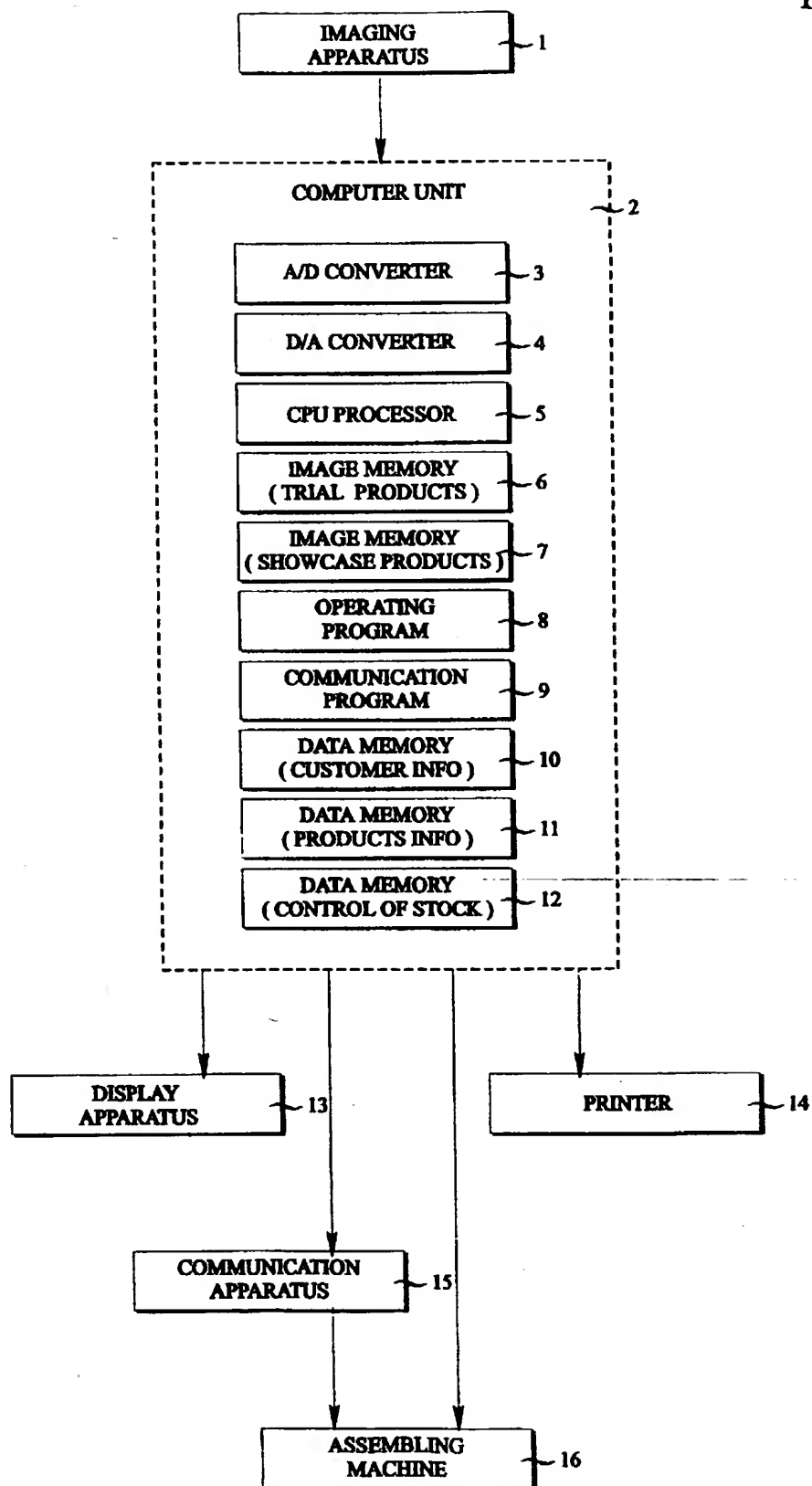
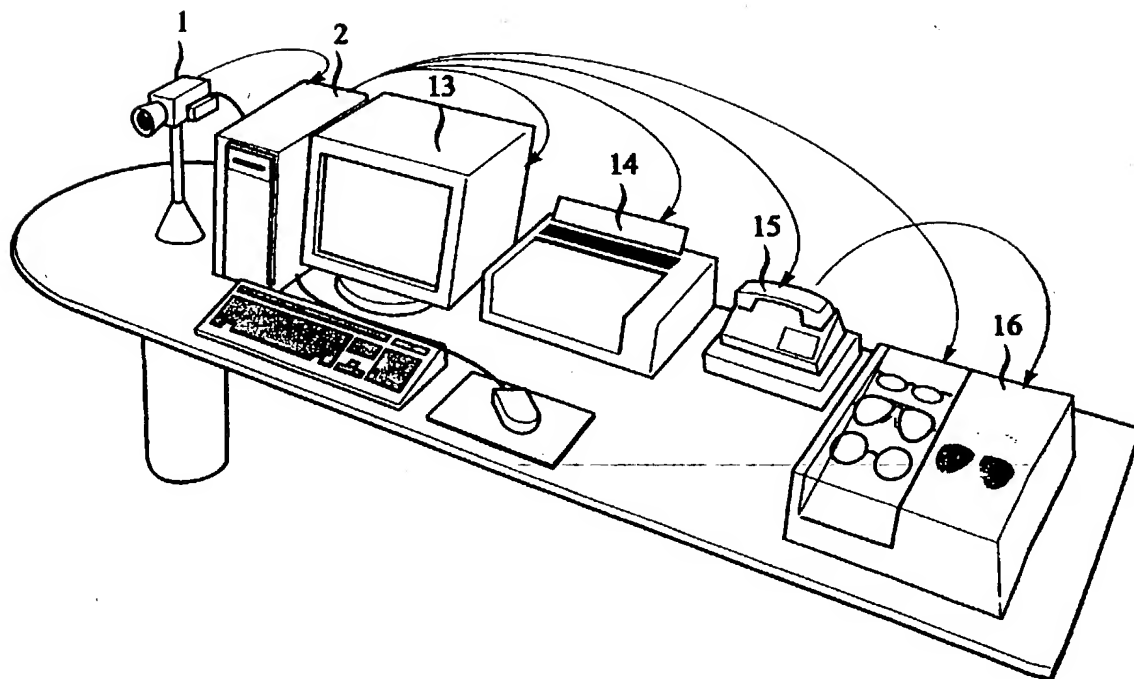


FIG. 2



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FIG. 3

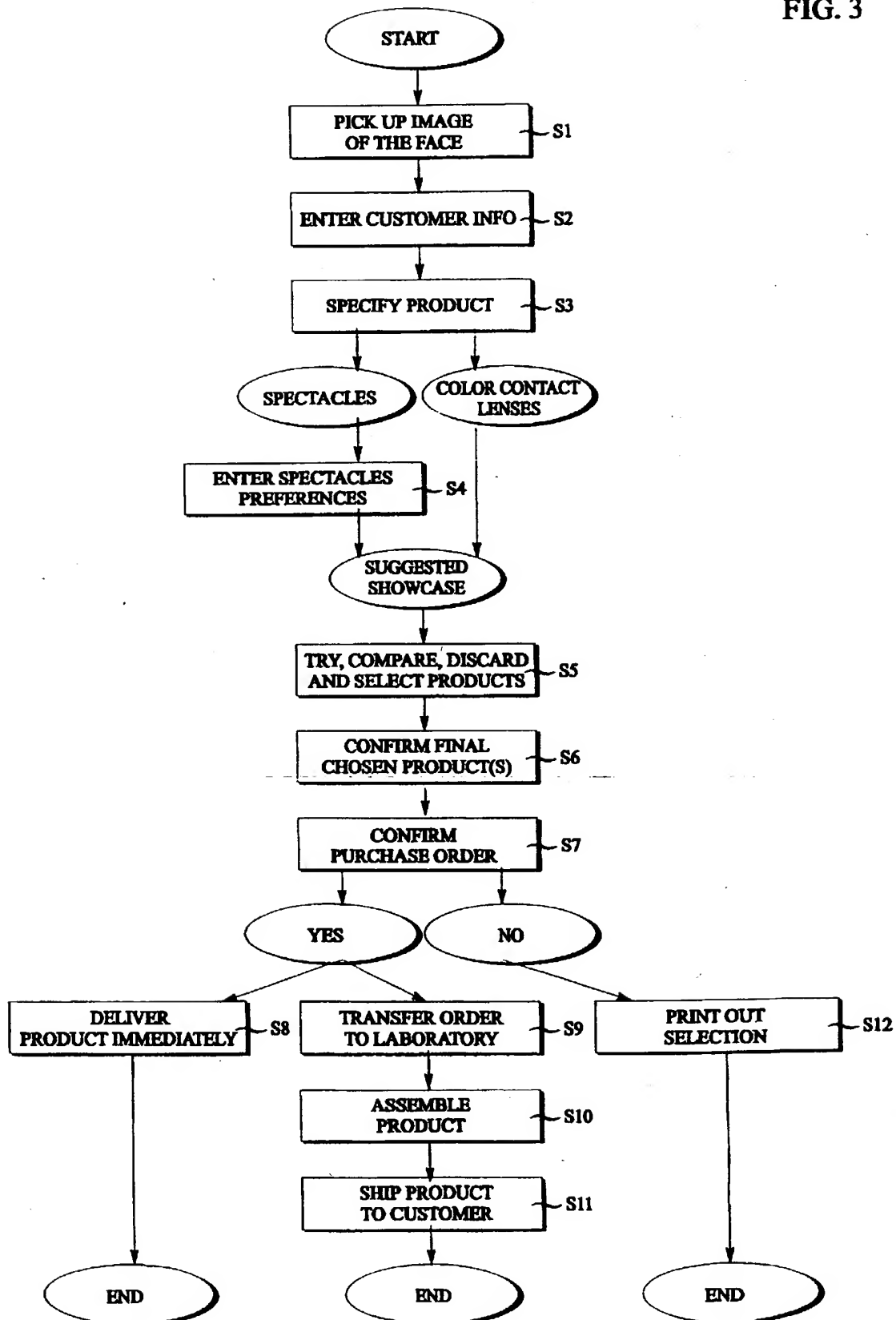
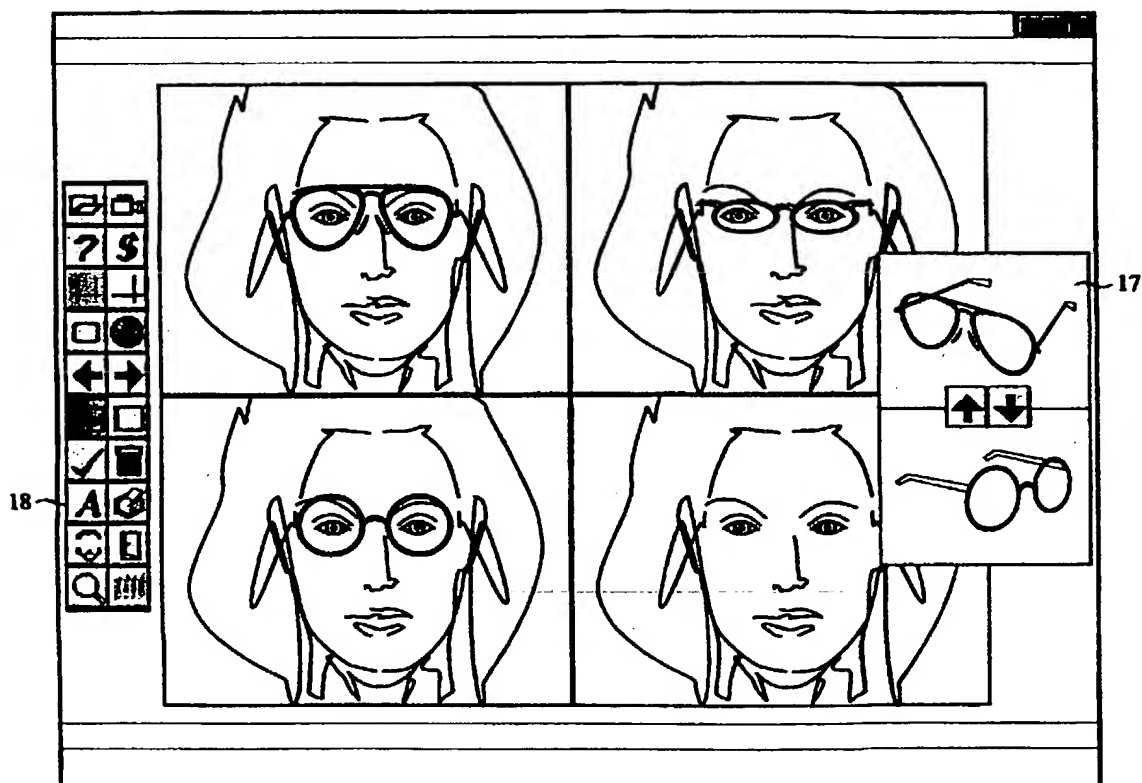


FIG. 4





FIG. 5



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/BR 97/00002

## A. CLASSIFICATION OF SUBJECT MATTER

IPC<sup>6</sup>: G 06 F 17/60

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC<sup>6</sup>: G 06 F 17/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

TXTUS 1, TXTUS 2, TXTEP 1, TXTGB 1, TXT WO 1

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4 852 184 A (TAMURA) 25 July 1989 (25.07.89), 30 pages; abstract; fig.1,21B,23,24.	1-3
Y	EP 0 576 268 A1 (HOYA) 29 December 1993 (29.12.93), 54 pages; abstract; fig.1.	1-3
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☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

09 May 1997 (09.05.97)

Date of mailing of the international search report

21 May 1997 (21.05.97)

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**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/BR 97/00002

The formulation of the claims uses too vague and indefinite terms, like "in which the whole activity of an optical shop may be simulated and/or automated".

The object of claim 2 seems to be obvious, as it belongs to the state of the art to access computers via Internet.

The object of claim 3 seems to be obvious, as it would occur to a person skilled in the art to store data coming from more than one (an unlimited number of?) suppliers (optical shops) into a data base.

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.

PCT/BR 97/00002

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